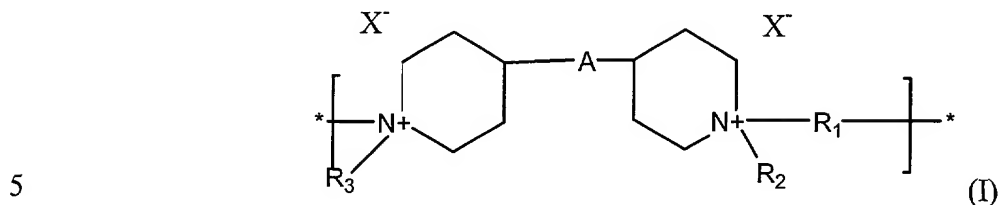


What is claimed is:

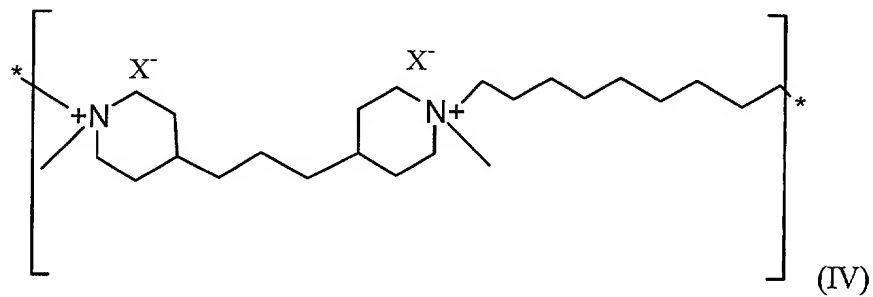
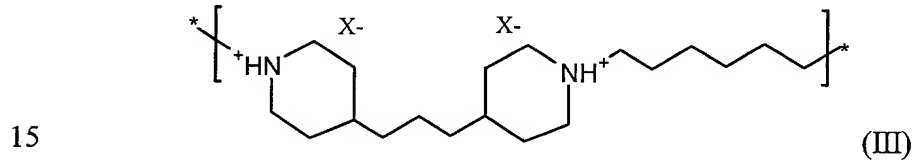
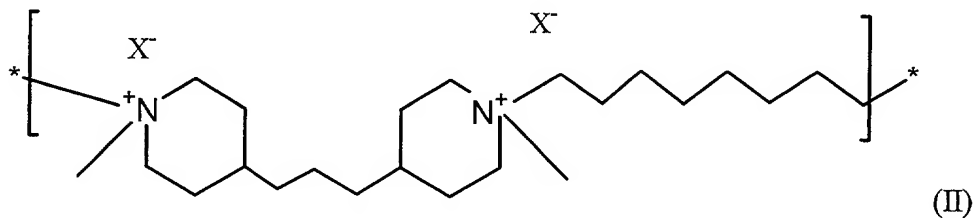
1. A polymer or copolymer characterized by a repeat unit having the formula:



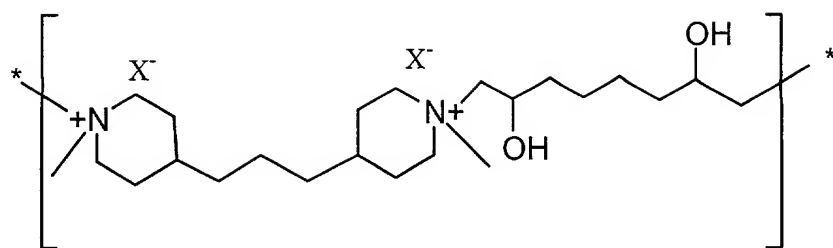
wherein R<sub>1</sub> is a substituted or unsubstituted lower alkylene group; R<sub>2</sub> and R<sub>3</sub> are each independently hydrogen or a substituted or unsubstituted lower alkyl; A is a bond or a substituted or unsubstituted lower alkylene group; and each X<sup>-</sup>, separately or taken together, is a physiologically acceptable anion.

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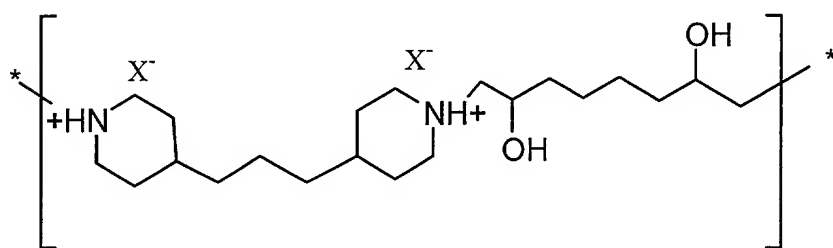
2. The polymer or copolymer of Claim 1 wherein the polymer or copolymer is characterized by a repeat unit of formula II, III or IV:



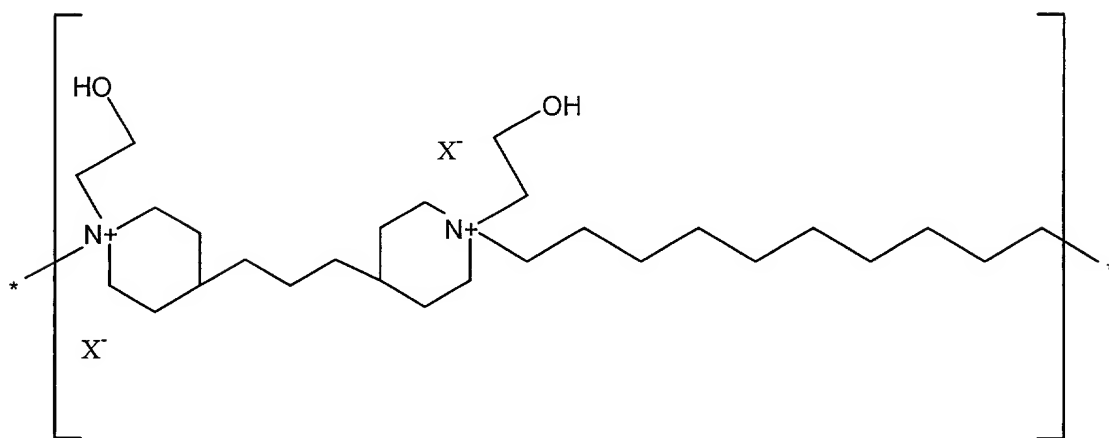
-38-



(V)



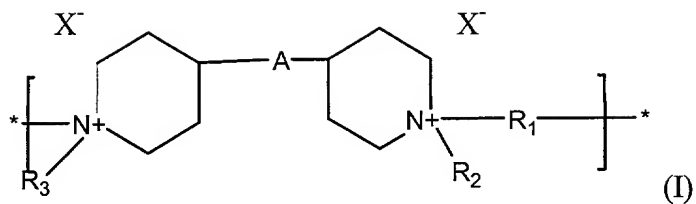
(VI)



(VII).

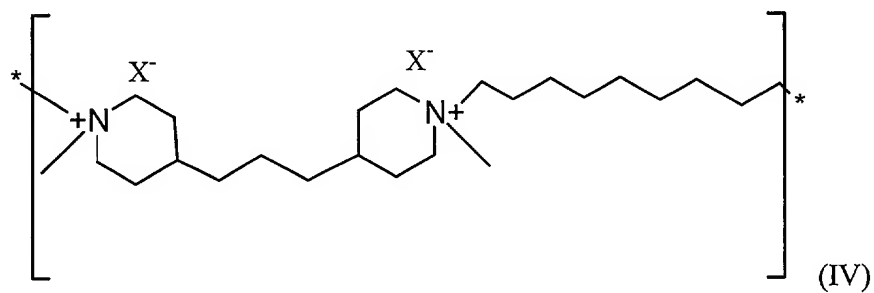
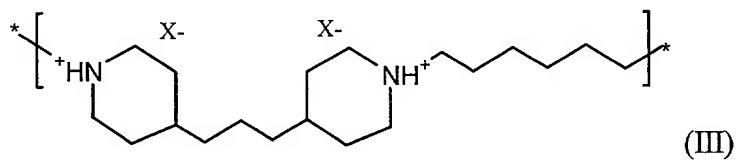
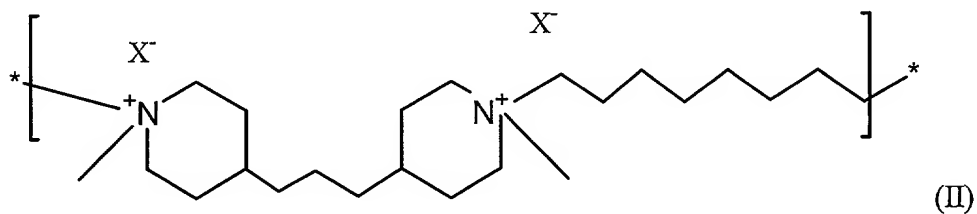
- 10 3. A pharmaceutical composition comprising a polymer or copolymer characterized by a repeat unit having the formula:

-39-



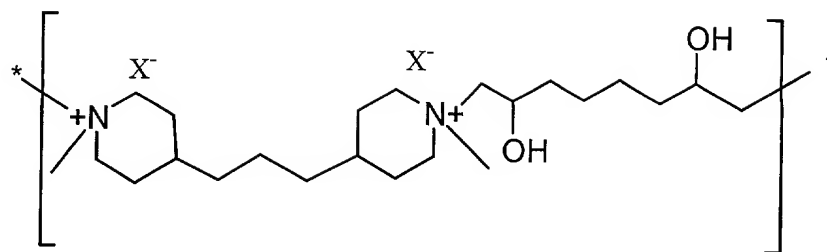
wherein  $R_1$  is a substituted or unsubstituted lower alkylene group;  $R_2$  and  $R_3$  are each independently hydrogen or a substituted or unsubstituted lower alkyl group;  $A$  is a bond or a substituted or unsubstituted lower alkylene group and each  $X^-$ , separately or taken together, is a physiologically acceptable anion; and a physiologically acceptable diluent or carrier.

4. The pharmaceutical composition of Claim 3 wherein the polymer or copolymer is characterized by repeat units of formula II, III or IV:

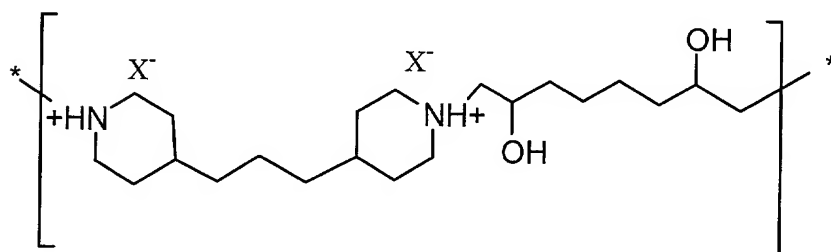


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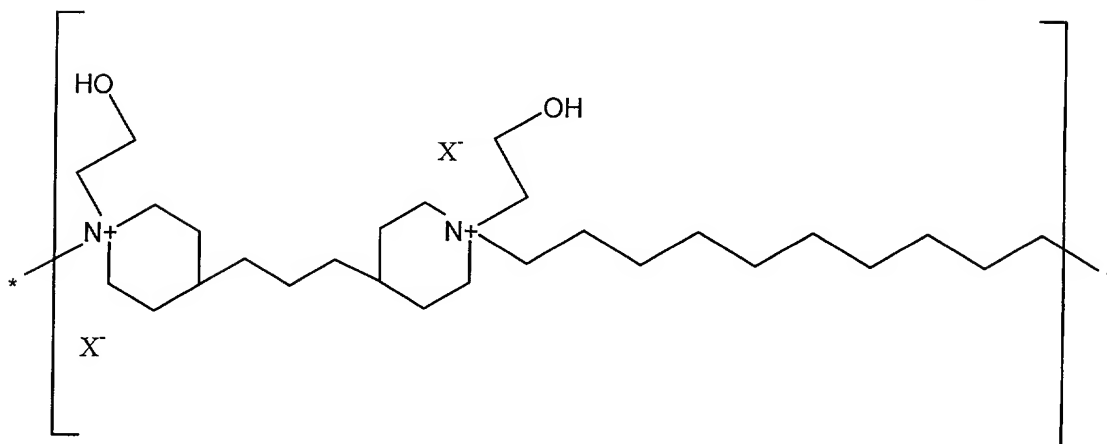
-40-



(V)



(VI)



(VII).

5. A method of treating a microbial infection in a mammal comprising the step of administering to said mammal a therapeutically effective amount of a polymer or copolymer of Claim 1.

6. A method of treating a microbial infection in a mammal comprising the step of administering to said mammal a therapeutically effective amount of a polymer or copolymer of Claim 2.

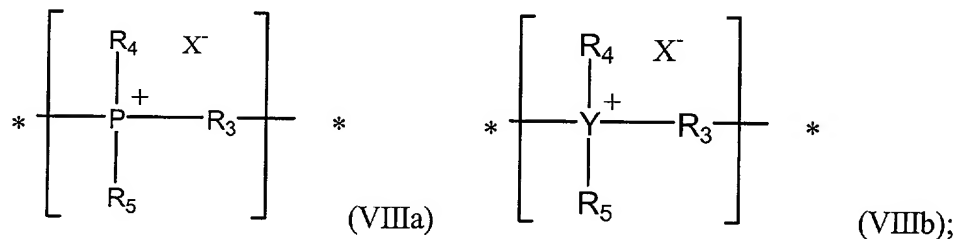
5 7. A method of treating a microbial infection in a mammal comprising the step of administering to said mammal a therapeutically effective amount of a pharmaceutical composition of Claim 3.

8. A method of treating a microbial infection in a mammal comprising the step of  
10 administering to said mammal a therapeutically effective amount of a pharmaceutical composition of Claim 4.

9. A method of inhibiting the growth of a microorganism on a surface comprising the step of contacting said surface with an effective amount of a polymer or copolymer  
15 of Claim 1.

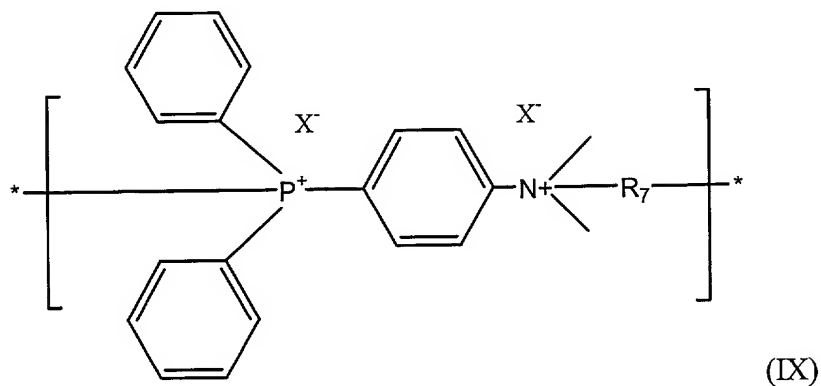
10. A method of inhibiting the growth of a microorganism on a surface comprising the step of contacting said surface with an effective amount of a polymer or copolymer of Claim 2.

20 11. A polymer or copolymer characterized by a repeat unit of formula VIIIa and a repeat unit of formula VIIIb:



wherein Y is P or N; R<sub>3</sub> is a substituted or unsubstituted arylene or lower alkylene  
25 group, R<sub>4</sub> and R<sub>5</sub> are independently a substituted or unsubstituted aliphatic or aromatic group; and each X<sup>-</sup> in the polymer or copolymer, separately or taken together, is a physiologically acceptable anion.

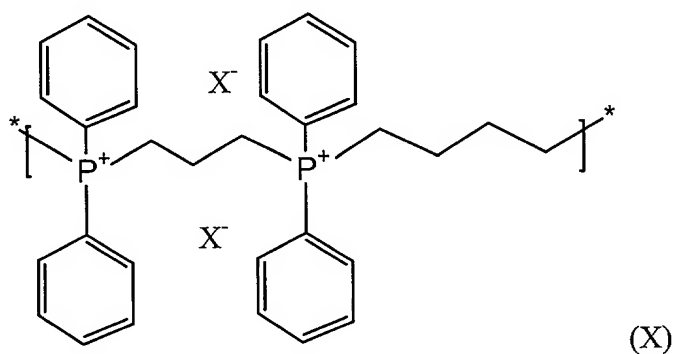
12. The polymer of copolymer of Claim 11, wherein the polymer or copolymer is characterized by repeat units of the formula:



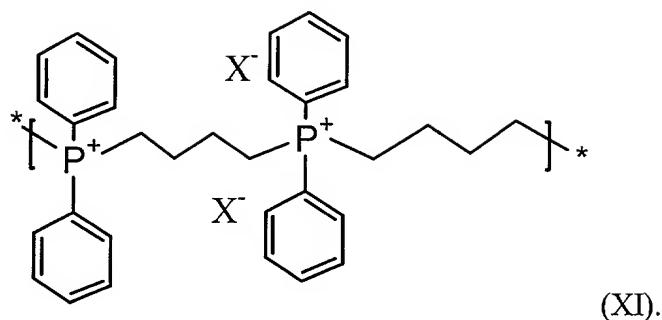
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wherein  $R_7$  is a substituted or unsubstituted lower alkylene group having from 1 to about 24 carbon atoms and each  $X^-$ , separately or taken together, is a physiologically acceptable anion.

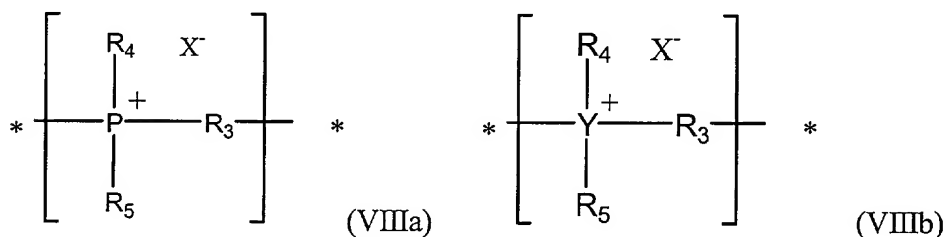
- 10 13. The polymer of copolymer of Claim 11 wherein the polymer or copolymer is characterized by repeat units of formula X or XI:



-43-

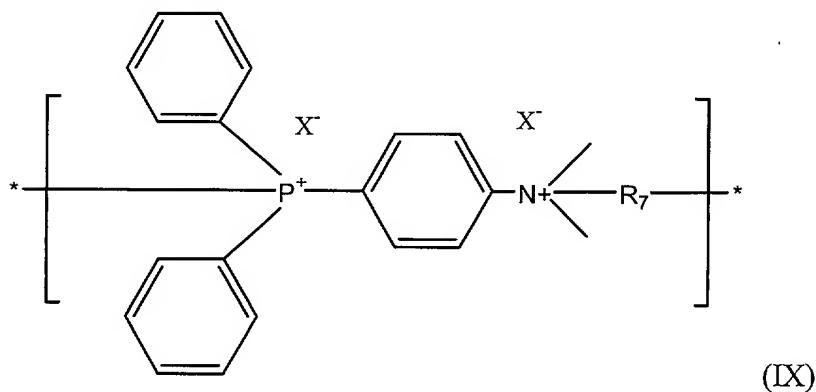


14. A pharmaceutical composition comprising a physiologically acceptable carrier or diluent and a polymer or copolymer characterized by a repeat unit of formula VIIIa and a repeat unit of formula Vb:



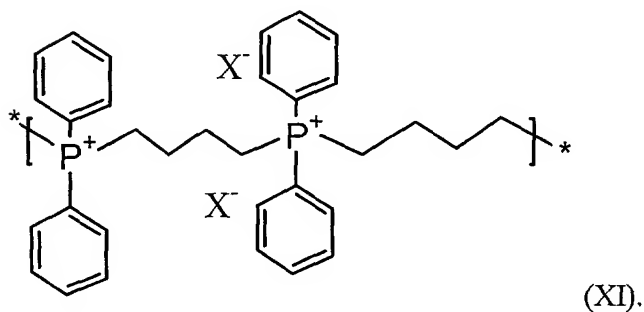
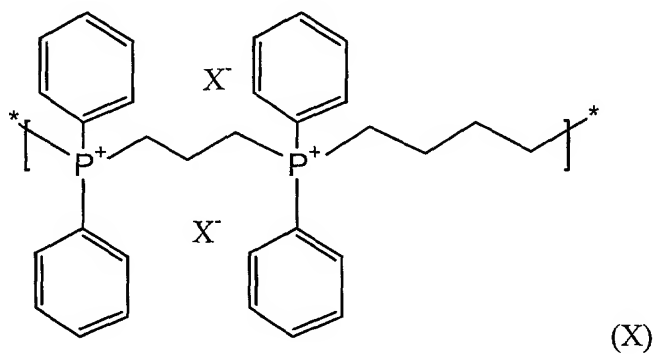
- wherein Y is P or N;  $R_3$  is a substituted or unsubstituted arylene or lower alkylene group,  $R_4$  and  $R_5$  are independently a substituted or unsubstituted aliphatic or aromatic group; and each  $X^-$  in the polymer or copolymer, separately or taken together, is a physiologically acceptable anion.

15. A pharmaceutical composition comprising a physiologically acceptable carrier or diluent and a polymer or copolymer characterized by a repeat unit of formula IX:



wherein  $R_7$  is a substituted or unsubstituted lower alkylene group having from 1 to about 24 carbon atoms and each  $X^-$ , separately or taken together, is a physiologically acceptable anion.

- 5 16. The pharmaceutical composition of Claim 14 wherein the polymer or copolymer is characterized by repeat units of formula X or XI:



- 10 17. A method of treating a microbial infection in a mammal comprising the step of administering to said mammal a therapeutically effective amount of a polymer or copolymer of Claim 11.
- 15 18. A method of treating a microbial infection in a mammal comprising the step of administering to said mammal a therapeutically effective amount of a polymer or copolymer of Claim 12.



19. A method of treating a microbial infection in a mammal comprising the step of administering to said mammal a therapeutically effective amount of a polymer or copolymer of Claim 13.

5 20. A method of treating a microbial infection in a mammal comprising the step of administering to said mammal a therapeutically effective amount of a pharmaceutical composition of Claim 14.

10 21. A method of treating a microbial infection in a mammal comprising the step of administering to said mammal a therapeutically effective amount of a pharmaceutical composition of Claim 15.

15 22. A method of treating a microbial infection in a mammal comprising the step of administering to said mammal a therapeutically effective amount of a pharmaceutical composition of Claim 16.

20 23. A method of inhibiting the growth of a microorganism on a surface comprising the step of contacting said surface with an effective amount of a polymer or copolymer of Claim 11.

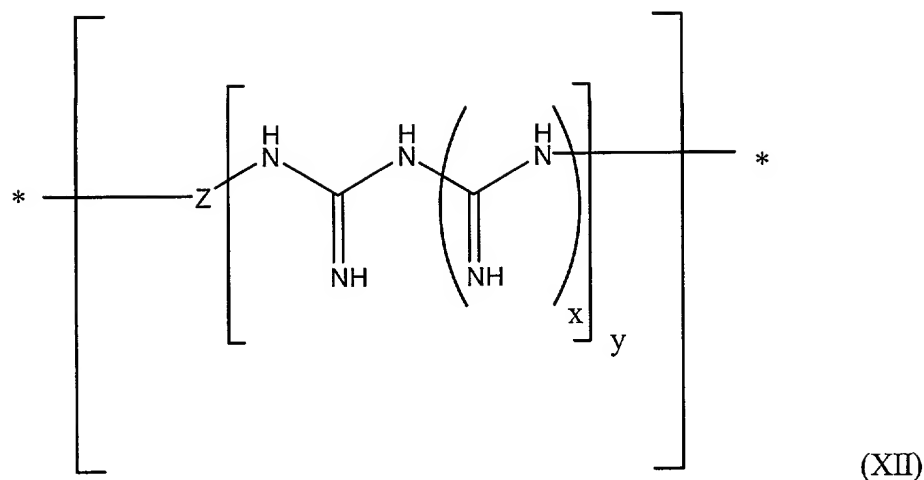
24. A method of inhibiting the growth of a microorganism on a surface comprising the step of contacting said surface with an effective amount of a polymer or copolymer of Claim 12.

25 25. A method of inhibiting the growth of a microorganism on a surface comprising the step of contacting said surface with an effective amount of a polymer or copolymer of Claim 13.

26. A polymer or copolymer characterized by a repeat unit having the formula:

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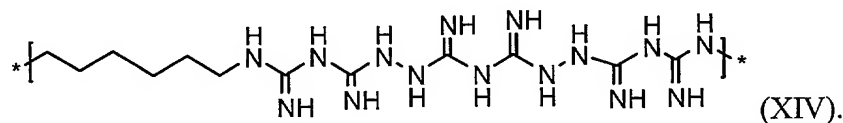
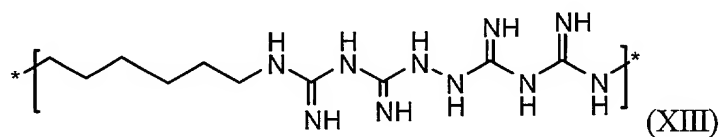
-46-



and physiologically acceptable salts thereof, wherein Z is a substituted or unsubstituted lower alkylene or lower alkylene glycol group; x is an integer from 1-4; and y is an integer from 2-5.

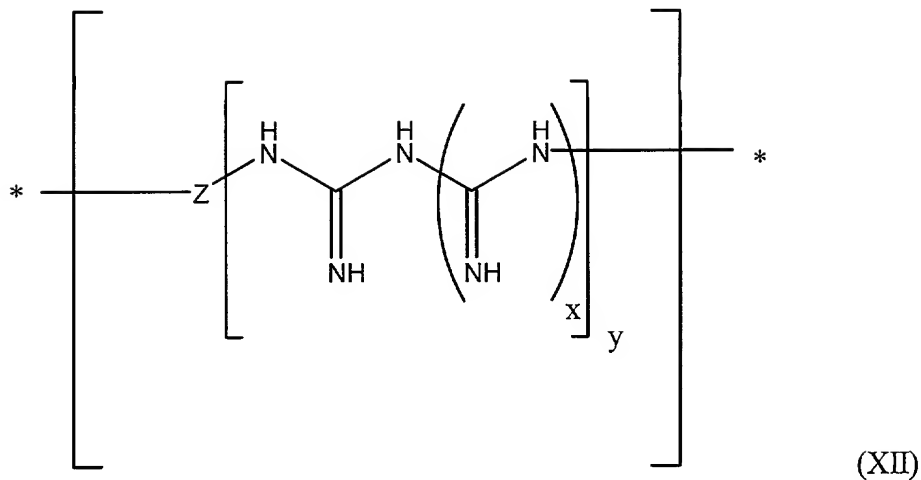
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27. The polymer or copolymer of Claim 26 wherein the polymer and copolymer are characterized by repeat units of formula XIII or XIV:



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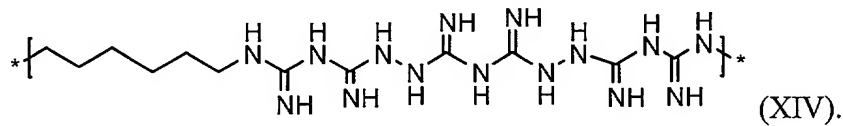
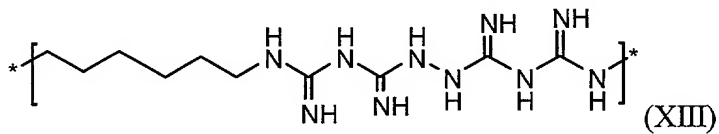
28. A pharmaceutical composition comprising a physiologically acceptable diluent or carrier and a polymer or copolymer characterized by a repeat unit having the formula:



or a physiologically acceptable salts thereof, wherein Z is a substituted or unsubstituted lower alkylene or lower alkylene glycol group; x is an integer from 1-4; and y is an integer from 2-5.

5

29. The pharmaceutical composition of Claim 28 wherein the polymer or copolymer is characterized by repeat units of formula XIII or XIV:



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30. A method of treating a microbial infection in a mammal comprising the step of administering to said mammal a therapeutically effective amount of a polymer or copolymer of Claim 26 or a pharmaceutically acceptable salt thereof.

15 31. A method of treating a microbial infection in a mammal comprising the step of administering to said mammal a therapeutically effective amount of a polymer or copolymer of Claim 27 or a pharmaceutically acceptable salt thereof.

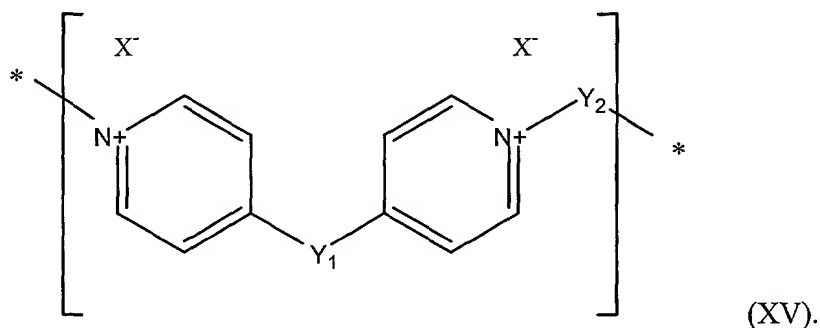
32. A method of treating a microbial infection in a mammal comprising the step of administering to said mammal a therapeutically effective amount of a pharmaceutical composition of Claim 28.

5 33. A method of treating a microbial infection in a mammal comprising the step of administering to said mammal a therapeutically effective amount of a pharmaceutical composition of Claim 29.

10 34. A method of inhibiting the growth of a microorganism on a surface comprising the step of contacting said surface with an effective amount of a polymer or copolymer of Claim 26 or a pharmaceutically acceptable salt thereof.

15 35. A method of inhibiting the growth of a microorganism on a surface comprising the step of contacting said surface with an effective amount of a polymer or copolymer of Claim 27 or a pharmaceutically acceptable salt thereof.

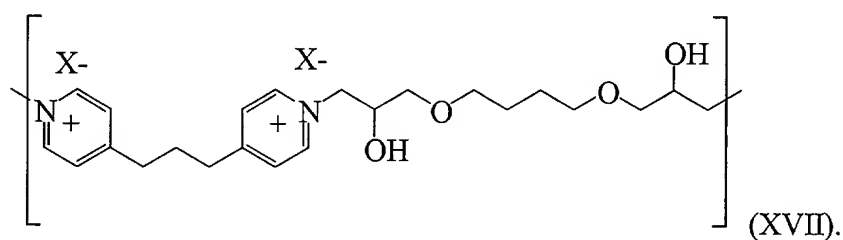
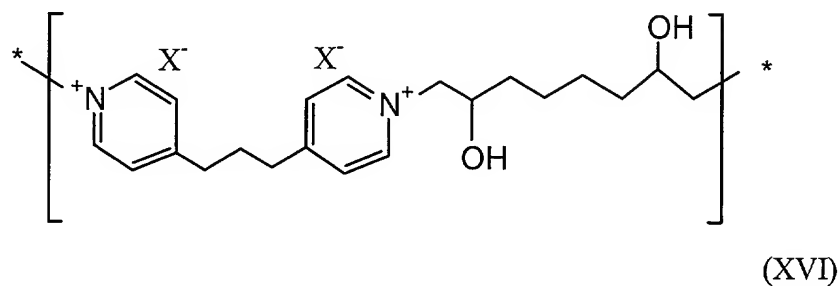
36. A polymer or copolymer characterized by a repeat unit having the formula:



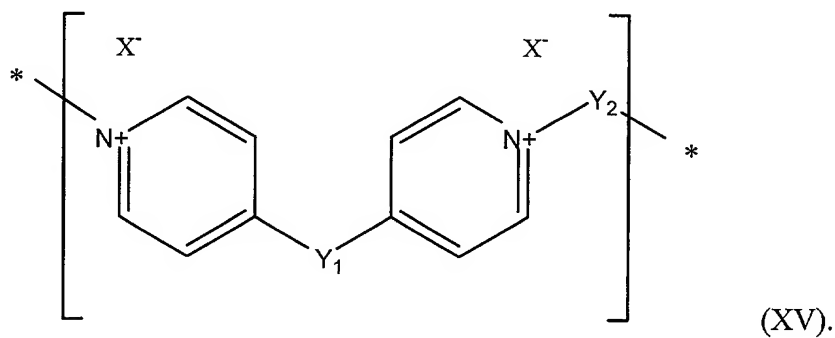
20 wherein  $Y_1$  and  $Y_2$  are independently a lower alkylene or lower alkylene glycol group, provided that  $Y_2$  is substituted with two or more alcohol groups; each  $X^-$ , separately or taken together, is a physiologically acceptable anion; and said polymer or copolymer is substantially free of diphenol.

25 37. The polymer of Claim 36, wherein said polymer is a homopolymer.

38. The polymer or copolymer of claim 36 wherein the polymer or copolymer is characterized by repeat units of formula XVI or XVII:



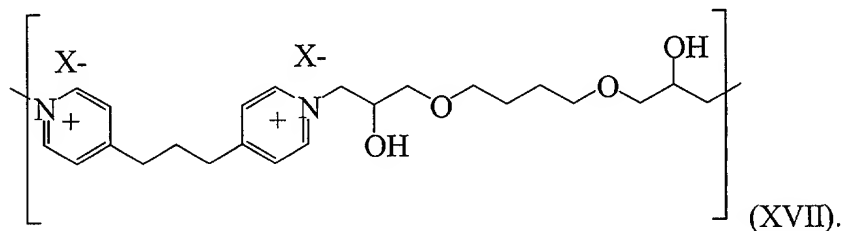
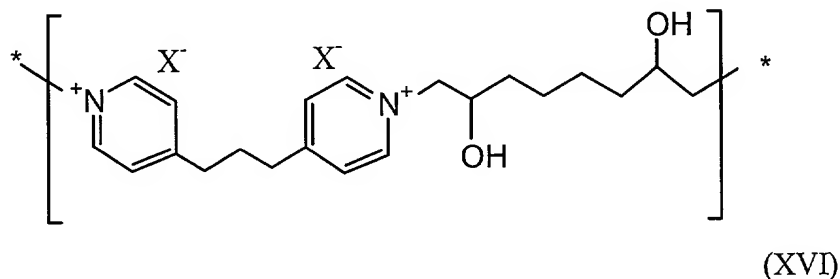
10 39. A pharmaceutical composition comprising a physiologically acceptable carrier or diluent and a polymer or copolymer characterized by a repeat unit having the formula:



15 wherein Y<sub>1</sub> and Y<sub>2</sub> are each independently a substituted or unsubstituted lower alkylene or lower alkylene glycol group; and each X<sup>-</sup>, separately or taken together, is a physiologically acceptable anion.

40. The pharmaceutical composition of Claim 39, wherein at least one lower alkylene or lower alkylene glycol group represented by Y<sub>1</sub> and Y<sub>2</sub> is substituted.

41. The pharmaceutical composition of Claim 39, wherein the polymer or  
5 copolymer is characterized by repeat units of formula XVI or XVII:



42. A method of treating a microbial infection in a mammal comprising the step of administering to said mammal a therapeutically effective amount of a polymer or copolymer of Claim 36.

43. A method of treating a microbial infection in a mammal comprising the step of administering to said mammal a therapeutically effective amount of a homopolymer of Claim 37.

44. A method of treating a microbial infection in a mammal comprising the step of administering to said mammal a therapeutically effective amount of a polymer or copolymer of Claim 38.

45. A method of treating a microbial infection in a mammal comprising the step of administering to said mammal a therapeutically effective amount of a pharmaceutical composition of Claim 39.

5 46. A method of treating a microbial infection in a mammal comprising the step of administering to said mammal a therapeutically effective amount of a pharmaceutical composition of Claim 40.

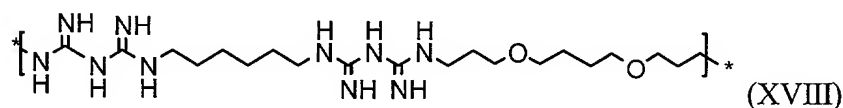
10 47. A method of treating a microbial infection in a mammal comprising the step of administering to said mammal a therapeutically effective amount of a pharmaceutical composition of Claim 41.

15 48. A method of inhibiting the growth of a microorganism on a surface comprising the step of contacting said surface with an effective amount of a polymer or copolymer of Claim 36.

20 49. A method of inhibiting the growth of a microorganism on a surface comprising the step of contacting said surface with an effective amount of a homopolymer of Claim 37.

50. A method of inhibiting the growth of a microorganism on a surface comprising the step of contacting said surface with an effective amount of a polymer or copolymer of Claim 38.

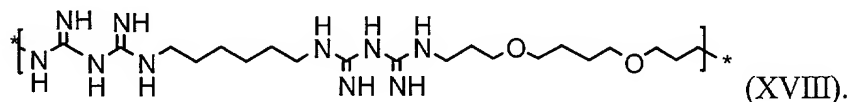
25 51. A polymer or copolymer characterized by a repeat unit having the formula:



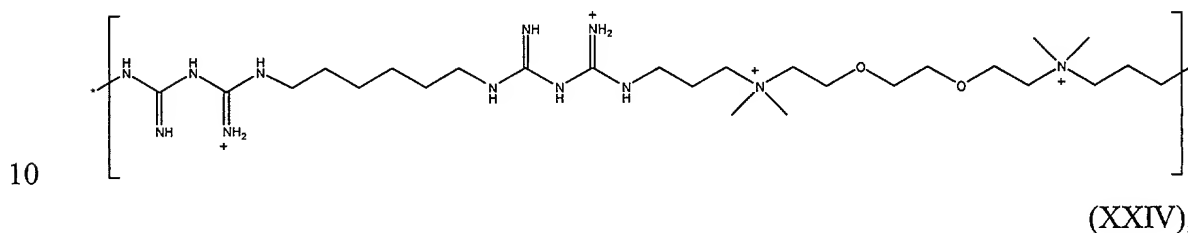
and physiologically acceptable salts thereof.

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52. A pharmaceutical composition comprising a polymer, copolymer or a physiologically acceptable salt thereof, and a pharmaceutically acceptable carrier or diluent, wherein the polymer and copolymer are characterized by a repeat unit having the formula:

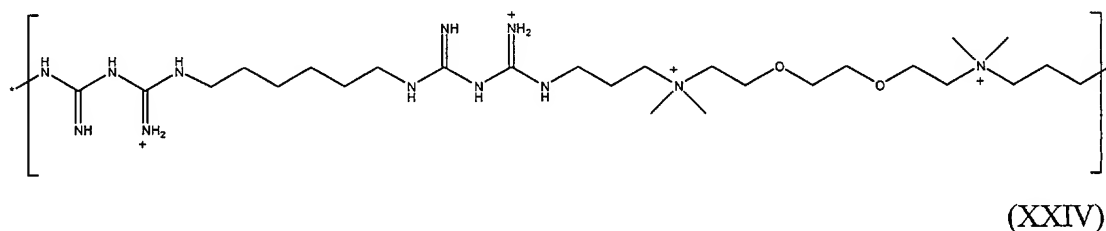


53. A polymer or copolymer characterized by a repeat unit having the formula:



and physiologically acceptable salts thereof.

54. A pharmaceutical composition comprising a polymer, copolymer or a physiologically acceptable salt thereof, and a pharmaceutically acceptable carrier or diluent, wherein the polymer and copolymer are characterized by a repeat unit having the formula:

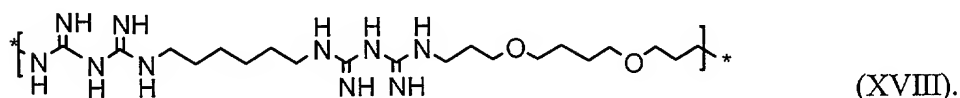


55. A method of treating a microbial infection in a mammal comprising the step of administering to said mammal a therapeutically effective amount of a pharmaceutical composition of Claim 52.



56. A method of inhibiting the growth of a microorganism on a surface comprising the step of contacting said surface with an effective amount of a polymer, copolymer or physiologically acceptable salt thereof, wherein the polymer or copolymer is characterized by a repeat unit having the formula:

5

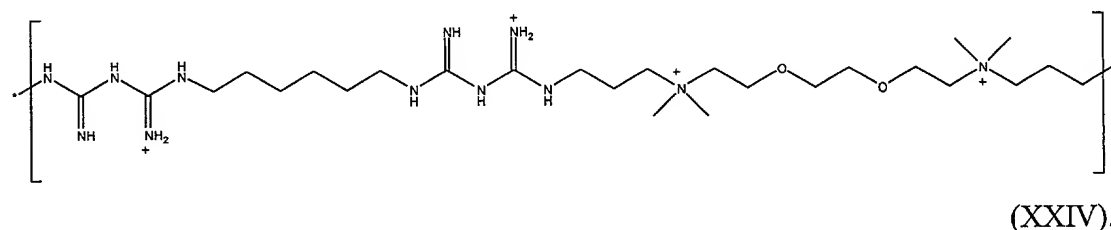


57. A method of treating a microbial infection in a mammal comprising the step of administering to said mammal a therapeutically effective amount of a pharmaceutical composition of claim 54.

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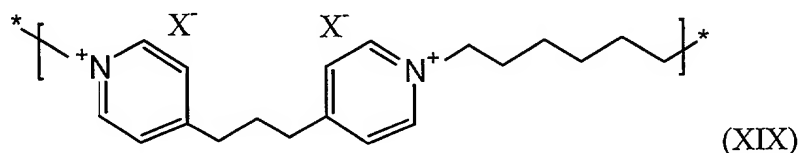
58. A method of inhibiting the growth of a microorganism on a surface comprising the step of contacting said surface with an effective amount of a polymer, copolymer or physiologically acceptable salt thereof, wherein the polymer or copolymer is characterized by a repeat unit having the formula:

15



59. A pharmaceutical composition comprising a polymer or copolymer characterized by a repeat unit having the formula:

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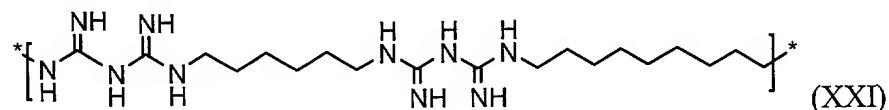
and a pharmaceutically acceptable carrier or diluent, wherein each X<sup>-</sup>, separately or taken together, is a pharmaceutically acceptable anion.

25

60. A method of treating a microbial infection in the gastrointestinal tract of a mammal comprising the step of administering to said mammal a therapeutically effective amount of a pharmaceutical composition of claim 59.

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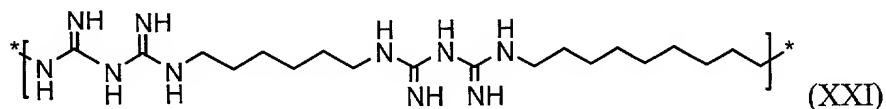
61. A polymer or copolymer characterized by a repeat unit having the formula:



and physiologically acceptable salts of the polymer and copolymer.

10

62. A pharmaceutical composition comprising a polymer, copolymer or a physiologically acceptable salt thereof, wherein the polymer or copolymer is characterized by a repeat unit having the formula:



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and a pharmaceutically acceptable carrier or diluent.

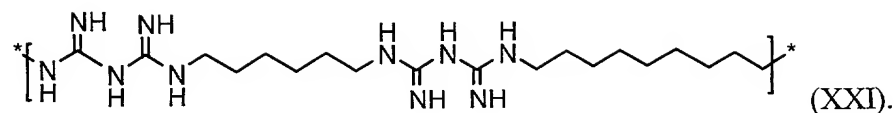
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63. A method of treating a microbial infection in a mammal comprising the step of administering to said mammal a therapeutically effective amount of a pharmaceutical composition of Claim 62.

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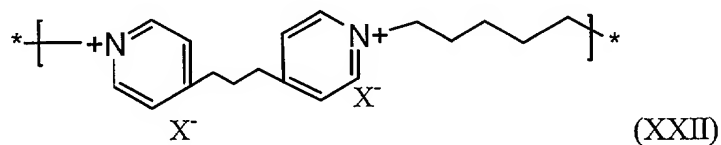
64. A method of inhibiting the growth of a microorganism on a surface comprising the step of contacting said surface with an effective amount of a polymer, copolymer or physiologically acceptable salt thereof, wherein the polymer or copolymer is characterized by a repeat unit having the formula:

-55-



65. A pharmaceutical composition comprising a polymer or copolymer characterized by a repeat unit having the formula:

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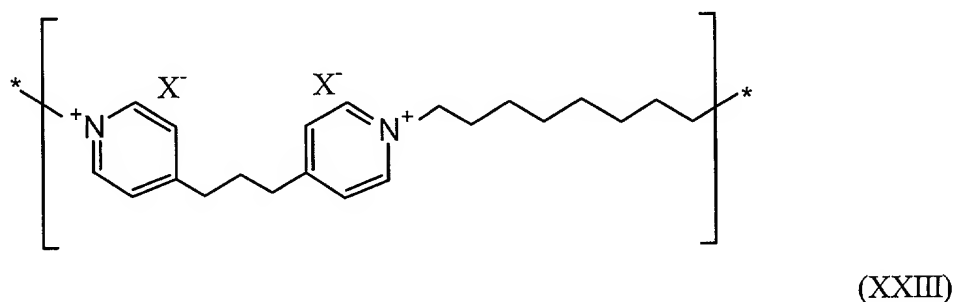


and a pharmaceutically acceptable carrier or diluent, wherein each  $\text{X}^-$ , separately or taken together, is a physiologically acceptable anion.

10

66. A method of treating a microbial infection of the oral mucosa or gastrointestinal tract of a mammal comprising the step of administering to said mammal a therapeutically effective amount of a pharmaceutical composition of claim 65.

15 67. A copolymer characterized by a repeat unit having the formula:



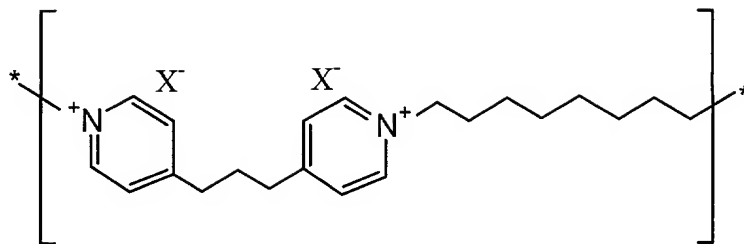
wherein each  $\text{X}^-$ , separately or taken together, is a physiologically acceptable anion.

20

68. A pharmaceutical composition comprising a polymer or copolymer characterized by a repeat unit having the formula:

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(XXIII),

and a pharmaceutically acceptable carrier or diluent, wherein each  $X^-$ , separately or taken together, is a physiologically acceptable anion.

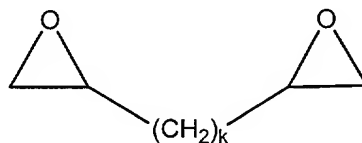
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69. A method of treating a microbial infection in a mammal comprising the step of administering to said mammal a therapeutically effective amount of a copolymer of claim 67.

10 70. A method of treating a microbial infection in a mammal comprising the step of administering to said mammal a therapeutically effective amount of a pharmaceutical composition of claim 68.

71. A method of inhibiting the growth of a microorganism on a surface comprising  
15 the step of contacting said surface with an effective amount of a copolymer of claim 67.

72. A method of preparing an ionene polymer, comprising the step of reacting an  $\alpha,\omega$ -diaminoalkane, a diepoxide represented by the formula:

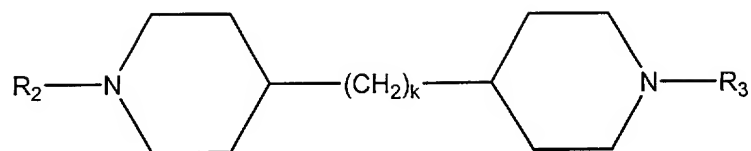


wherein  $k$  is an integer from 1 to 10, and an acid.

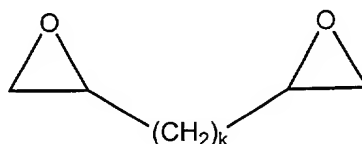
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73. A method of preparing an ionene polymer, comprising the step of reacting an  $\alpha,\omega$ -alkylenedipiperidine represented by the formula:

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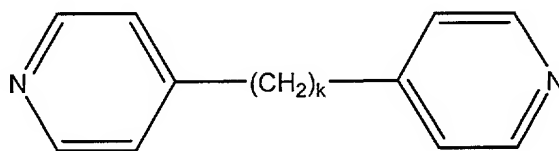
wherein k is an integer from 1 to 10 and R<sub>2</sub> and R<sub>3</sub> are each independently hydrogen or a substituted or unsubstituted lower alkyl group, a diepoxide represented by the formula:



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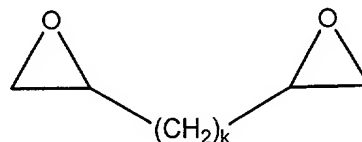
wherein k is an integer from 1 to 10, and an acid.

74. A method of preparing an ionene polymer, comprising the step of reacting an  $\alpha,\omega$ -alkylenedipyridine represented by the formula:



10

wherein k is an integer from 1 to 10, a diepoxide represented by the formula:



wherein k is an integer from 1 to 10, and an acid.

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